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Short Communication

Bioefficacy of newer insecticide molecules against tomato fruit borer, *Helicoverpa armigera* (Hübner)

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Tomato Fruit Borer, *Helicoverpa armigera* (Lepidoptera: Noctuidae) is a polyphagous pest which feeds on more than 150 crops and attacking the major crops like cotton, tomato, okra, pigeon pea, gram etc. (Sharma *et al*., 2011; Sarate *et al*., 2012; Vinutha *et al*., 2013). This pest is widely distributed in tropics, subtropics and warmer temperate regions of the world as well as in India. Out of several insect pests attacking tomato crop *H. armigera* has a major threat and constraints in the higher production of tomato yield and crop causing significant yield loss (Talekar *et al*., 2006; Singh *et al*., 2011). Young larvae of fruit borer feed on the foliage and late larval instars bore inside the fruits and fruits are contaminated with the excreta. Such fruits are not preferred by consumers. The holes made on the fruits are circular and the larva feed on keeping the head portion only inside the hole. To control this pest and to save the crop, pesticides are being used in large quantities and due to this development of resistance in *H. armigera* was reported (Kranthi *et al.,* 2002; Chaturvedi, 2013) and also pesticides causes problem of pesticide residues in foodstuff and other environmental contamination. Over-dependence of a particular group of chemical is one of the important reasons for rapid development of resistance in *H. armigera*. This has promoted the necessity for the development of newer and known insecticidal alternatives that could be feasible and effective for insect pest management. The present investigation was therefore undertaken to test the effectiveness of newer molecules in controlling *H. armigera* in tomato in comparison to conventional insecticide.

A field experiment was conducted with tomato variety "Rohit" in Randomized Block Design in the experimental farm of Agricultural Research Station, Borwat Farm, MPUAT, Banswara during *Rabi* seasons of 2010-11 and 2011-12. Main crop was planted in plots of 4.5 X 2.7 m with row to row and plant to plant spacing of 60 and 45 cm, respectively. Seedlings were transplanted on 20th December, 2010 and 25th December, 2011. There were 7 treatments replicated three comprising of insecticides, Chlorantraniliprole 18.5 SC (Coragen) at two different doses (20 and 25 g a.i./ha), Emamectin benzoate 5 SG (Proclaim) @ 11 g a.i./ha, Indoxacarb 16.8 EC (Avant) @ 40 g a.i./ha, Thiodicarb 75 WP (Larvin) @ 750 g a.i./ha and Acephate 75 SP (Asataf) @ 500 g a.i./ha. The control plot was sprayed with water only. These insecticides were sprayed at 50% flowering and then followed by 15 days after first spray. For recording observations, five randomly selected plants were chosen to count the number of fruit borer larvae, the rate of infestation of fruits by *H. armigera* was taken into account at each picking. The pre-treatment count was made a day before each spray while, the post treatment counts were made on 7th and 14th day after each spray. The fruit yield per plot was also recorded at each harvest.

All the insecticidal treatments were effective and significantly superior to control. Pretreatment observations showed that the number of larvae ranged from 5.22 to 6.66 per five plants. The seventh day counts after each spray revealed that the larval population was in the range of 1.66 to 6.33 larvae per five plants and the application of Chlorantraniliprole 18.5 SC (at 20 and 25 g a.i./ha) and Emamectin benzoate 5 SG at 11g a.i./ha were equally as effective reducing the larval population of *H. armigera* when compared to other newer insecticides and Acephate. Larval counts showed that, all the treatments were significantly ($p < 0.05$) superior to untreated check. Similar trends were observed at 14th day after spray (DAS). However on 14th day after spray two doses (at 20 and 25 g a.i./ha) of Chlorantraniliprole 18.5 SC were still effective when compared to other molecules. In these treatments the larval population was 1.90 and 2.30 in Chlorantraniliprole 18.5 SC at 20 and

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25 g a.i./ha, respectively. The present observations on the effectiveness of Emamectin benzoate are in conformity with those of Kumar and Devappa (2006) in brinjal against *L. orbonalis*, Kanna *et al*. (2005) in tomato against *H. armigera*.

Data pertaining to fruit infestation indicated that the mean per cent fruit damage in the treatments varied from 6.46 to 27.97 during 2010-11 and 7.67 to 23.07 during 2011-12. The results on efficacy of different insecticides showed that during both the years, Chlorantraniliprole 18.5 SC at 25 g a.i./ha treatment gave excellent control of tomato fruit borer followed by Chlorantraniliprole 18.5 SC at 20 g a.i./ha, Emamectin benzoate 5 SG at 11 g a.i./ha, Thiodicarb 75 WP at 750 g a.i./ha, Indoxacarb 16.8 EC at 40 g a.i./ha. Whereas, conventional insecticide, Acephate 75 SP @ 500 g a.i./ha was though inferior than rest of the treatments but were quite effective than control.

Several workers recommended the use of different insecticides *viz.,* malathion, endosulfan and carbaryl, against *H.armigera* (Singh, 1970) but these insecticides sometimes fail to provide desire level of protection. However, synthetic pyrethroids have been reported most effective against fruit borer (Ashok Kumar, 2008). Similar studies were conducted by Suganya Kanna *et al.* (2005) and Murugaraj *et al.* (2006) against fruit borer, reporting the superiority of emamectin benzoate over Lambda cyhalothrin and Spinosad while Sivakumar *et al.* (2003) reported the superiority of Profenophos over Cypermethrin and Dichlorvos with respect to mean larval population and per cent fruit damage. Kumar and Shivaraju (2009) also reported newer molecules like Beta cyfluthrin 9% + Imidacloprid 21% - 300 OD was very effective in suppressing the larval population compared to Monocrotophos 36 SL and Endosulfan 35 EC. This could be due to different climatic conditions and timing and number of insecticidal applications.

In case of effect on fruit yield, the spraying with Emamectin benzoate recorded 31.5 and 33.4 q/ha during 2010-11 and 2011-12, respectively which was higher over the other treatments. Similar studies were conducted by Kanna *et al.* (2005) and Murugaraj *et al.* (2006) against fruit borer, reporting the superiority of Emamectin benzoate over Lambda cyhalothrin and Spinosad. Within the treatments, the two doses of Chlorantraniliprole and the other newer molecules Thiodicarb and Indoxacarb were recorded higher tomato yields when compared to untreated control. Similarly, Dhaka *et al.* (2010) observed that the lowest fruit infestation and highest yield of tomato in Indoxacarb treated plots of tomato.

The data in terms of economics of different insecticides indicated that all the insecticidal treatments recorded increase in marketable yield over untreated check. Spraying with Emamectin benzoate followed by Chlorantraniliprole 18.5 SC at 20 and 25 g a.i./ha were cost-effective treatment recording high additional return over other treatments and untreated control. Emamectin benzoate recorded highest mean marketable yield (32.45 t ha-1) and net profit (Rs. 221910.00) then followed by Chlorantraniliprole 18.5 SC at 20 (mean marketable yield :28.40 t ha^{-1}) and 25 g a.i./ha (mean marketable yield: 28.15 t ha^{-1}) with the net profit of Rs. 193703.33 and Rs. 192783.33 for 25 and 20 g a.i./ha, respectively.

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